WATER QUALITY ANALYSIS OF SUKHNA LAKE, CHANDIGARH

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ABSTRACT

Water assessment of Sukhna Lake was carried out in the month of November 2009 by selecting ten spots for obtaining water samples. During these investigations, various parameters like pH, temperature, total dissolved solids, nitrate & phosphate have studied. It has been observed that pH has been found to be on the alkaline side. Total dissolved solids and nitrates were found to be within permissible limits while phosphate concentration was beyond the desirable range. The increasing concentrations of phosphate that is responsible for 'eutrophication' in the Lake, may be due to run-off from agricultural fields. It may have many adverse effects on the living organisms in thelake.

Key Words: *Sukhna Lake, Water analysis, Water assessment, Lake Pollution, phosphate concentration*

INTRODUCTION

This 3 km² rain fed lake was created in 1958 by damming the Sukhna Choe, a seasonal stream coming down from the Shivalik Hills. Originally the seasonal flow entered the lake directly causing heavy siltation. To check the inflow of silt, land measuring 25.42 km² was acquired in the catchment area and put under vegetation. In 1974, the Choe was diverted and made to by-pass the lake completely, the lake being fed by three siltation ports, minimizing the entry of silt intothelakeitself.Thetotalcatchmentareaofthelakeis4,207hectares,outofwhich3,312

hectares constitute the Shivalik hills and the remaining area of 895 hectares falls in three villages of Kaimbwala (Chandigarh), Kansal (Punjab), Suketri (Haryana). Sukhna Lake is the venue for many festive celebrations the most popular is the Mango Festival held during the monsoons when scores of varieties of mangoes are on display. The lake also has a full-length watercourse developed in 1989 when the city hosted the 1989 Asia Rowing Championship. Sukhna is a sanctuary for many exotic migratory birds like the Siberian duck, Storks and Cranes, during the winter months. As many as 98 species of birds belonging to 60 genera, 34 families and 15 orders have been observed (Jindal and Ghazeta, 1989). About 30 species are residents and the rest are migratory, mainly the winter migrants. Pisciculture is the main economic activity associated with the lake. According to the information provided by U.T. Administration the annual fish catch had been 30 tons in 1987, 33 tons in 1988, 35 tons in 1989 and 37 tons in 1990. Fish seed of about a dozen different fishes is introduced in the lake periodically (thrice a year) and few wild types also occur. During the last hundred years or so, deforestation and wind-water borne soil erosion have been steadily increasing and have now become a major environmental problem all over the world and in India (Barrow, 1991; Saha *et.al.*, 1991; Mehta and Singh, 1995; Boardman and FavisMortlock,1993;Jones,1993;Kayastha,1992;Grewal*et.al.*,1990;KukalandSur,1992;

Kiran *et.al.*, 1998; Hynes, 2003; Sachidanandamurthy and Yajurvedi, 2006; Dixit *et.al.*, 2006, Tamrakar *et.al.*, 2011). Also many workers have done commendable work on various aspects of lake (Bansal and Mishra, 1982; Johal and Tandon, 1983a and 1983b; Bansal and Grewal, 1987; Jindal and Ghezta, 1989).

There being no river in the vicinity, people visit Sukhna to perform religious ceremonies and after each such ceremony the Sukhna Lake presents a gloomy picture as people leave behind a huge amount of waste in the lake. The lake is already facing threat due to accumulation ofsilt

during rains and these ceremonies round the year further aggravate the problem. Finally, with the objective to curb this practice and to maintain ecological balance of the Sukhna Lake, the Chandigarh Administration prohibited religious ceremonies and rituals at the lake up to January 18, 2008 as performing of rituals was causing water pollution. The number of sick birds, both wild and domesticated, continues to mount at the Sukhna Lake in Chandigarh (as published by Susan Sharma on 1/30/2007). Water pollution in Sukhna could be a possible cause. Dead storage level and pollution level in the Lake has been rising. Therefore, in case of Sukhna, testing of water samples is an absolute necessity.

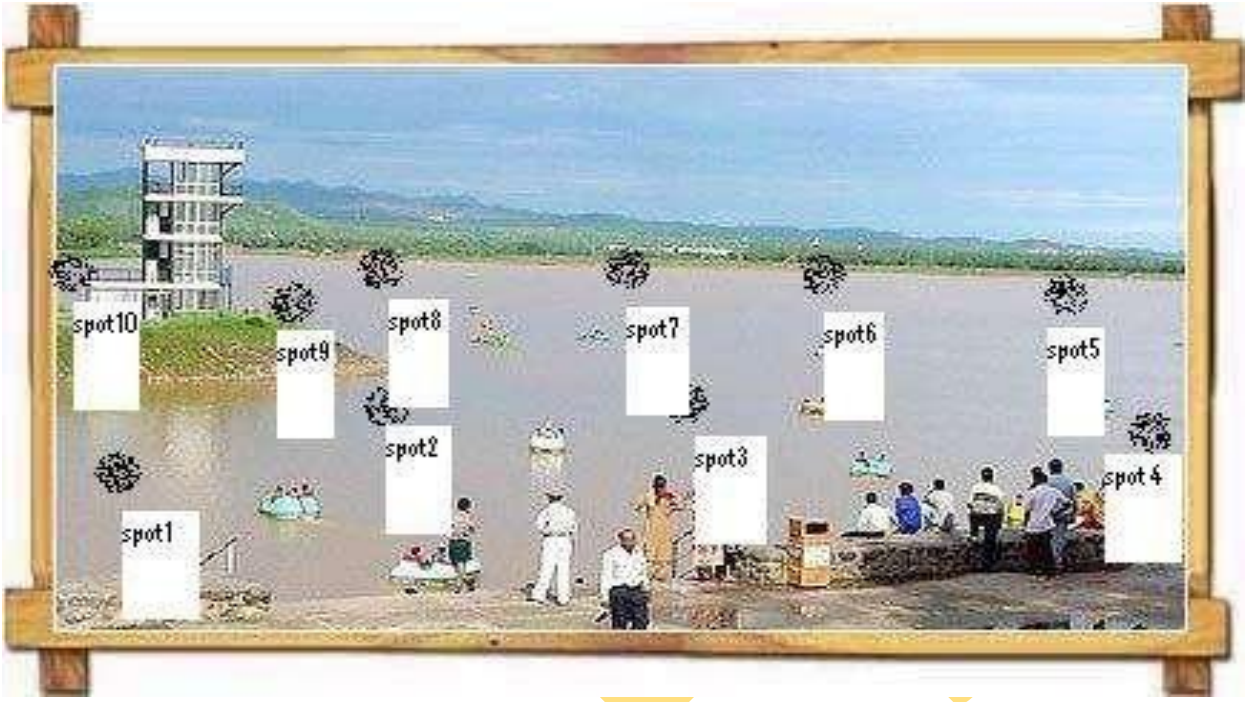
MATERIALS AND METHODS

Sampling Spots

Sukhna Lake located at 32º 42' N (latitude) and 76º 54' E (longitude) is roughly kidney shaped. Its northern boundary adjoining the Shivalik Hills is natural and irregular and southwest embankment is artificially built made up of stones.

All the ten spots from where the sample collection had been done are shown in Fig.1. The sampling was done in the month of November, 2009. All the samples were collected in sterilized polyethylene bottles and stored in refrigerator at 4^0C. All the parameters were analyzed APHA, 2000.

Fig. 1 A VIEW OF SUKHNA WETLAND SHOWING TEN SAMPLING SPOTS



EXPERIMENTAL DETAILS

The parameters studied for each sample of lake water included temperature, pH, electrical conductivity, total dissolved solids, nitrates & phosphates.

(a) Estimation ofTemperature

Temperature was estimated using a thermometer at the time of the sample collection on the lake. The thermometer was dipped into the lake water and held in the middle for sometime and the temperature reading was noted down.

(b) Estimation ofpH

pH of the water sample was measured using a pH meter after calibrating the pH water with buffer solution of pH 4.0 and 9.0 and then taken reading of the samples.

(d) Estimation of Total Dissolved Solids (TDS)

Total solids was determined by subtracting the initial weight of the crucible with filter paper from the final weight of a dried sample (minus tare) divided by the original sample volume. Preheated a 100 ml evaporating dish at 550 ^{0}C for 1 hour, cooled in a in a drying oven for 15-20 minutes, brought to room temperature in a desiccators and weighed. Repeat until a constant weight was achieved. Measure 50ml of sample and added this to the pre-weighed. Then evaporated to dryness in a drying oven set at 105. Finally cooled in a desiccator and weighed.

Estimation of Nitratecontent

Nitrate content of the water samples was estimated using spectrophotometer.

Requirements:

Standard solution of nitrate: It was prepared by dissolving 0.7218 g of KNO_3in1000mlofdistilledwater.Thestandardsolutionsof0.0,0.1,0.2,0.3,0.4,0.5,0.6,

0.7, 0.8, 0.9 and 1.0 were prepared.

Procedure:

Nitrate concentration was estimated by spectrophotometer. To 50 ml clear sample, 1 ml of 1 N HCI solution was added. The solution was shaken thoroughly and poured into the cuvette. Readings were taken directly from spectrophotometer whose wavelength was set previously at 220 nm. The nitrate concentration in the water samples was obtained from a calibration curve prepared by taking a range of standard nitrate solutions.

Estimation of Phosphate content

Phosphate content of the water samples was estimated using spectrophotometer.

Requirements:

- Standard phosphate solution:- It was prepared by adding 0.438g KH_2PO_4 in100ml

distilled water. The standard solutions of 0.0, 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6, 1.8 and 2.0 were prepared.

- Ammonia molybdate solution:- Diluted 2.5g of molybdate in 15 ml distilledwater. Diluted 28ml of concentrated H_2SO_4 with distilled water to make 40ml. Both the solutions were mixed and final volume was made 100ml distilledwater.
- Stannous chloride solution:- 2.5g of $SnCl_2$ and 10ml of concentrated HCl were added to distilled water and final volume was made100ml.

Added 2 ml of ammonium molybdate and 5 drops of stannous chloride in distilled water to prepare blank and similarly added to each standard solution. Blue colour appeared. Instrument was set at 690 nm with blank. Reading was taken between 5 -10 minutes duration because blue colour which appears due to the formation of complex of unknown concentration starts fading after 12 minutes. Standards were run and O.D. (readings) was noted down. Standard curve was prepared between concentrations of standard solutions and the O.D. Samples were run & O.D. displayed on the 'Read Out' was noted down. From the standard curve, phosphate conc. of the water samples was estimated.

RESULTS & DISCUSSION

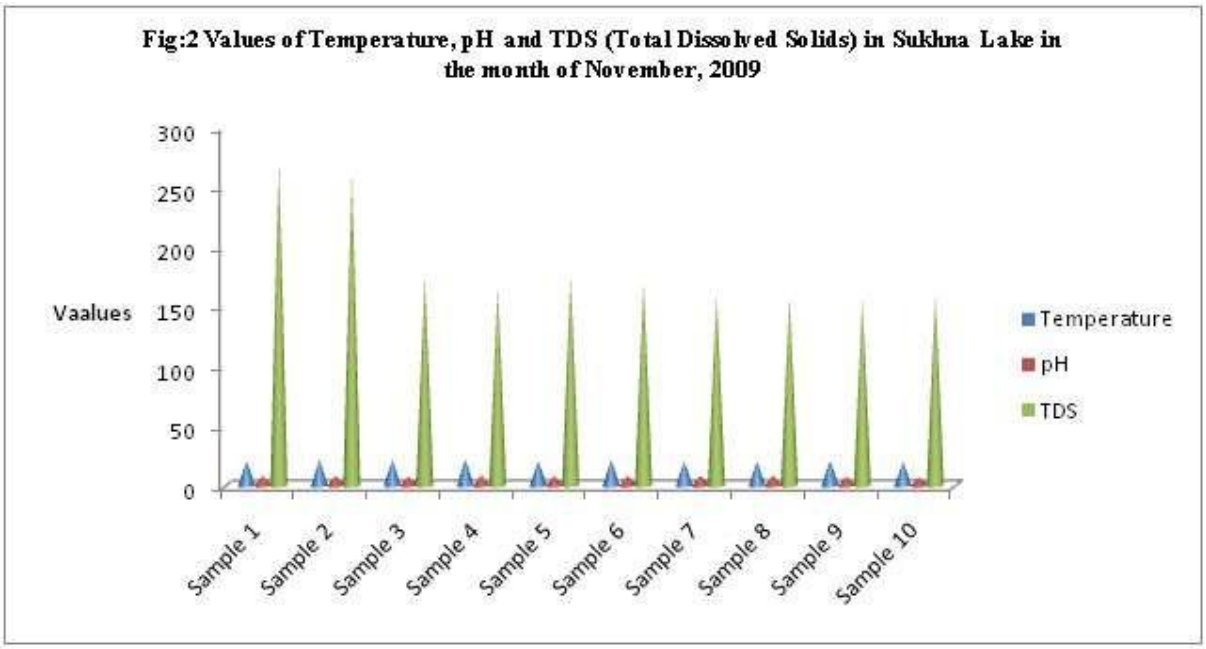


Fig.2: Values of Temperature, pH and TDS (Total Dissolved Solids) in Sukhna Lake in the month of November, 2009

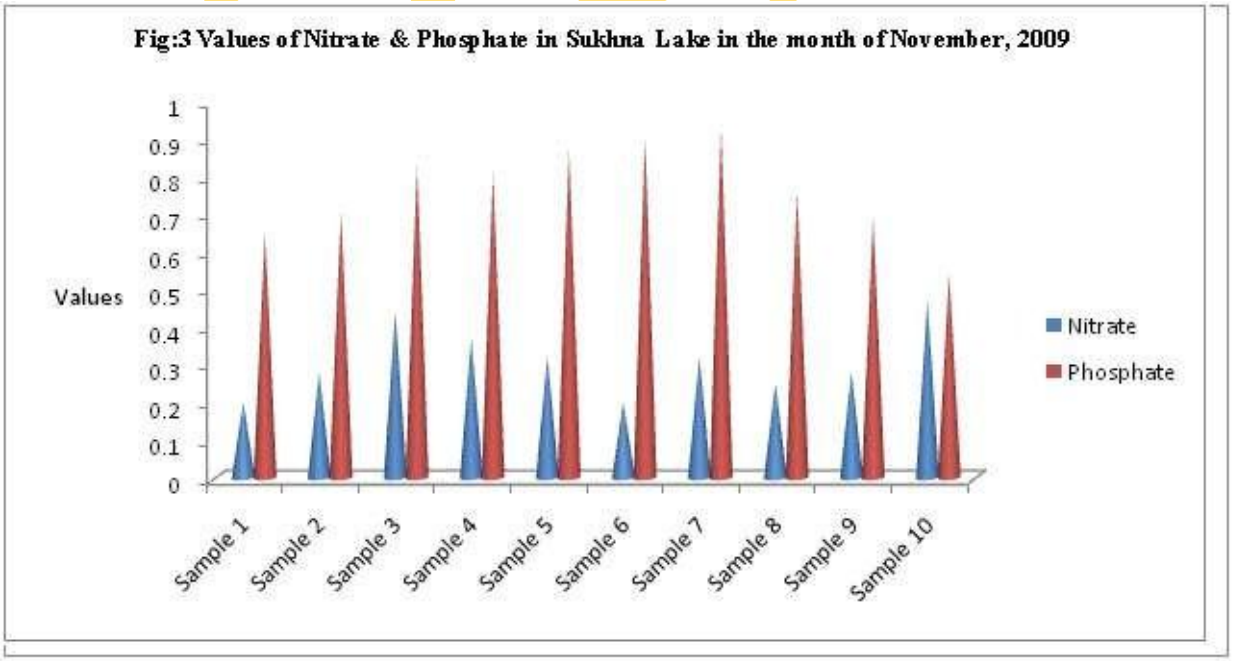


Fig.3: Values of Nitrate & Phosphate in Sukhna Lake in the month of November, 2009

The temperature of the Sukhna Lake was found to be in between the range 20 and 21^0 C during the first sampling in November, 2009 (Fig.2). The accepted pH range of the water by Union Health Ministry is 7.0 to 8.5 but may be tolerated up to the range of 6.5 -9.2 if any other source is not available. As the pH of the samples taken are in the range of 6.9 to 8.3 (Fig.2). Thus the range of the water samples is almost within the range of the acceptability and is harmless for the aquatic life in terms of the pH level of the water body. The range of the TDS value of samples taken in the first sampling is 155 to 270 mg/l. and is acceptable for aquatic life. The major route of entry of nitrogen into this lake water is runoff from fertilized agricultural field. Nitrogen level was plant growth (which in turn are food for micro-fauna and larger animals); i.e., even if there are plenty of other nutrients such as nitrates and carbonates, algae and plants will not grow if there is not enough phosphate content in the water. Nitrogen level was found to be with in limits (Fig.3). Phosphate being a good nutrient for whole aquatic life (flora as well as fauna) is accepted up to a level of 5 mg/l as its high concentration leads to damage to aquatic life by devastating the oxygen from water. Phosphate level in the lake is very high (Fig.3) and it is not in the permissible limits of environmental pollution. It may have many adverse effects on the living organisms in thelake.

CONCLUSION

Sukhna Lake catches the attention of so many tourists every year but water quality of this Lake has been deteriorating at very fast rate due to man-made activities. Phosphate concentration has already increased significantly that is of great concern due to its property to enhance “Eutrophication”. Though Chandigarh administration has taken various steps for “Cleanliness” of Sukhna Lake, still there is enough to do for this Lake at individuallevel.

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